



Missouri Department of Natural Resources

Total Maximum Daily Load (TMDL)

for

Lake St. Louis,
St. Charles County, Missouri

Completed September 11, 2001
Approved November 19, 2001

**Total Maximum Daily Load (TMDL)
For Lake St. Louis
Pollutant: Chlordane**

Name: Lake St. Louis

Location: Near O’Fallon and Lake St. Louis in
St. Charles County, Missouri

Hydrologic Unit Code (HUC): 7110009-010001

Water Body # (WBID): 7054

Missouri Lake Class: L3¹

Beneficial Uses²:

- Livestock and Wildlife Watering
- Protection of Warm Water Aquatic Life and Human Health associated with Fish Consumption
- Whole Body Contact Recreation (Swimming)

Size of Impaired Segment: 525 acres

Location of Impaired Segment: Dam in Section 26, T47N, R2E

Pollutant: Chlordane

Pollutant Source: Urban nonpoint runoff

TMDL Priority Ranking: Low



1. Background and Water Quality Problems

Peruque Creek flows northward into the Mississippi River just north of St. Louis. Lake St. Louis was formed by damming a portion of the creek as part of plans for a new community. The town of Lake St. Louis was first conceived in 1966 as a private weekend recreational lake community. One of the original investors, Mr. R. T. Crow, felt its location between two major highways (I-70 and Rt. 61) and the westward growth of St. Louis justified building a “new town”, rather than just a weekend community. He investigated the idea of new towns, including visiting two others in the east: Reston, Virginia, and Columbia, Maryland. In the end, he bought out the other investors and became the sole developer of the Lake St. Louis community. St. Charles County

¹Class L3 lakes are lakes other than major reservoirs or those used primarily for public drinking water supply. These lakes may be either public or private. See Missouri’s Water Quality Standards 10 CSR 20-7.031(1)(F)

² The beneficial uses may be found at 10 CSR20-7.031 (1)(C) and Table G

approved the first preliminary plan for Lake St. Louis in April 1967 and for 12 years the only governing body was a community association. Construction on the dam for the 600-acre Lake St. Louis began in 1968. It was completed in 1973 and Crow filed for bankruptcy the next year. The community finally became a city in 1975.

Soil erosion rates for rural areas in this part of the state are estimated by the St. Charles County Soil Survey to be 6-7 tons per acre per year; however, in urbanizing areas construction site erosion is far greater. Much of the basin above the Mississippi River floodplain has become an urban area. Most of the soil north of the lake is classified as Harvester-Urban land complex with a 2-9 percent slope. The lowland soil around the lake is the nearly level Dockerty silt loam with moderate permeability and slow runoff. Along the south side of the lake are steep wooded slopes of Gross cherty silt loam soil that have moderate permeability with fast runoff. Above this rise is more urban development on Weller silt loam, which exhibits slow permeability and moderate runoff.

Lake St. Louis was dredged regularly for several years when there was much highway and commercial construction nearby. It is still dredged as needed. In recent years, the lake has been under a health advisory to limit consumption of fish due to chlordane contamination. Urban runoff from the very development that gave birth to the lake is the source of this contamination.

Chlordane is a pesticide that was once widely used for termite control and in agriculture. The substance was applied both in dwellings and around foundations to repel and kill termites, ants and a variety of other insects, especially through the 1970s and 1980s. The U.S. Environmental Protection Agency (EPA) banned chlordane for agricultural uses in 1975 and for all other uses in 1988. Even though it has been banned, chlordane degrades very slowly in the environment. Chlordane is not soluble and is not found in the water column of waterbodies, but attaches to soil and through erosion moves into a waterbody and accumulates in lake or streambed sediments. It bio-accumulates in fish tissue, and bottom-feeding fish such as carp become exposed to chlordane due to their feeding or dwelling preferences near chlordane-contaminated sediments. Eating fish contaminated by chlordane will not immediately make a person ill; however, over a long period of time, chlordane may damage the nervous system, digestive system and the liver. It also has produced cancers in laboratory animals.

The Missouri Department of Conservation (MDC) has monitored levels of toxic contaminants in fish from Missouri lakes and rivers since 1984. At that time, MDC discovered elevated levels of chlordane in fish in the Missouri, Mississippi and Meramec rivers. MDC provides these sample results to the Missouri Department of Health (DOH) for use in determining health risks to fish consumers. DOH, in turn, issues fish consumption advisories. DOH has issued advisories based on pesticide contaminants in fish since 1985. DOH fish advisories in the past instructed anglers to limit consumption of fatty fish (carp, catfish, buffalo, drum, suckers and paddlefish) to one meal per week. Trout also have a high level of fat, but are considered safe to eat from anywhere in the state. DOH issues its fish advisory every year around June-July. The advisory is made available to the public through press releases and may be accessed by calling DOH at 1-800-392-7245. DOH also distributes the advisory in brochures at fairs and MDC publishes the fish advisory in the Summary of Missouri Fishing Regulations pamphlet.

Missouri's protocol for removing or down grading an advisory requires at least two years of data. Fish tissue data from Lake St. Louis in the last two years shows chlordane has been below the

0.3 milligrams per kilogram (mg/kg) action level (see Specific Criteria in section 2). As a result, DOH discontinued the warning on fatty fish in the latest fish advisory released July 9, 2001.

2. Description of the Applicable Water Quality Standards and Numeric Water Quality Targets

Beneficial Uses

The beneficial uses of Lake St. Louis, WBID 7054, are:

- Livestock and Wildlife Watering
- Protection of Warm Water Aquatic Life and Human Health associated with Fish Consumption
- Whole Body Contact Recreation

The use that is impaired is Protection Human Health associated with Fish Consumption. Chlordane is very insoluble in water and therefore is not a concern for swimming or animal watering.

Anti-degradation Policy

Missouri's Water Quality Standards include the Environmental Protection Agency (EPA) "three-tiered" approach to anti-degradation, which may be found at 10 CSR 20-7.031(2).

Tier I defines baseline conditions for all waters and it requires that existing beneficial uses are protected. TMDLs would normally be based on this tier, assuring that numeric criteria (such as dissolved oxygen and ammonia) are met to protect uses.

Tier II requires that no degradation of high-quality waters occur unless limited lowering of quality is shown to be necessary for "economic and social development." A clear implementation policy for this tier has not been developed, although if sufficient data on high-quality waters are available, TMDLs could be based on maintaining existing conditions, rather than the minimal Tier I criteria.

Tier III (the most stringent tier) applies to waters designated in the water quality standards as outstanding state and national resource waters; Tier III requires that no degradation under any conditions occurs. Management may prohibit discharge or certain polluting activities. TMDLs would need to assure no measurable increase in pollutant loading.

This TMDL will result in the protection of existing beneficial uses, which conforms to Missouri's Tier I anti-degradation policy.

Specific Criteria

The specific criteria for chlordane are found in Missouri's Water Quality Standards, 10 CSR 20-7.031, Table A, under Persistent, Bioaccumulative, Man-made Toxics. The limit for chlordane *in water* related to human health protection associated with fish consumption is 0.00048 micrograms per liter (µg/L or parts per billion). However, elevated chlordane levels in water

have never been a problem. As chlordane tends to bioaccumulate in fish, this TMDL will be based on fish tissue chlordane levels. Fish tissue levels refer to the amount of chlordane in the fillet, or edible portion, of fish. The U.S. Food and Drug Administration (FDA) developed a fish tissue action level of 0.3 milligrams per kilogram (mg/kg or parts per million) for technical grade chlordane.³ Note: 1 kilogram equals approximately 2.2 pounds. If the level of a toxic contaminant exceeds the action level, a fish consumption advisory is issued regarding the potential health risk associated with long-term consumption of contaminated fish. The first documented exceedence for chlordane in Lake St. Louis was in 1987 and a fish consumption advisory was issued. As noted previously, Missouri's protocol for removing or down grading an advisory requires at least two years of chlordane data below 0.3 mg/kg. Since this requirement has been met, the advisory was discontinued July 9, 2001.

3. Calculation of Load Capacity

Load capacity is defined as the maximum pollutant load that a waterbody can assimilate and still attain water quality standards. EPA banned the use of chlordane in 1988, so no additional chlordane is being introduced into the environment. Thus, the Load Capacity, Load Allocation and Waste Load Allocation for this TMDL are zero.

4. Margin of Safety (MOS)

The fish consumption advisory that has been in effect for Lake St. Louis since 1987 has just been discontinued. Since chlordane has been banned, chlordane levels in fish are predicted to continue to decline. To ensure that public health and safety are protected, if future monitoring shows a rise in fish tissue chlordane, the fish consumption advisory will be reissued and the cause and cure for the increase will be investigated.

5. Seasonal Variation

There is no seasonal variation associated with this TMDL.

6. Monitoring Plans for TMDL under the Phased Approach

The department will continue to request the Missouri Department of Conservation to collect fish tissue samples from Lake St. Louis for chlordane analysis.

7. Implementation Plans

Since chlordane has been banned, there is no specific remediation plan for this impairment. This is a phased TMDL in that if future data indicates fish tissue chlordane levels are not continuing to decline, this TMDL will be re-opened and re-evaluated. This TMDL will be incorporated into Missouri's Water Quality Management Plan.

³ Data can be collected as sum-of-the-isomers chlordane and in that case the action level is 0.1 mg/kg sum-of-the-isomers chlordane. This is usually comparable to FDA's action level of 0.3 mg/kg technical grade chlordane when the contamination is recent because there is a lot of the technical chlordane still present. However, after a few years the chlordane all breaks down to the isomers, so the comparison no longer works well. For the purposes of this TMDL, 0.3 mg/kg technical grade chlordane will be used.

8. Public Participation

This water quality limited lake is included on the approved 1998 303(d) list for Missouri. Six public meetings on impaired waters to allow input from the public were held between August 18 and September 22, 1998. No comments pertaining to Lake St. Louis were received during the public meetings. TMDLs developed by Missouri are sent to EPA for examination and then the edited drafts are placed on public notice. . This TMDL was placed on public notice from August 3 through September 2, 2001. One letter of comment was received, but no changes were made to the TMDL document. A copy of the notice, comment received and the department response was included in the Lake St. Louis file.

9. Appendices and List of Documents on File with the Department

Appendix A – Land Use Types for the Lake St. Louis Watershed

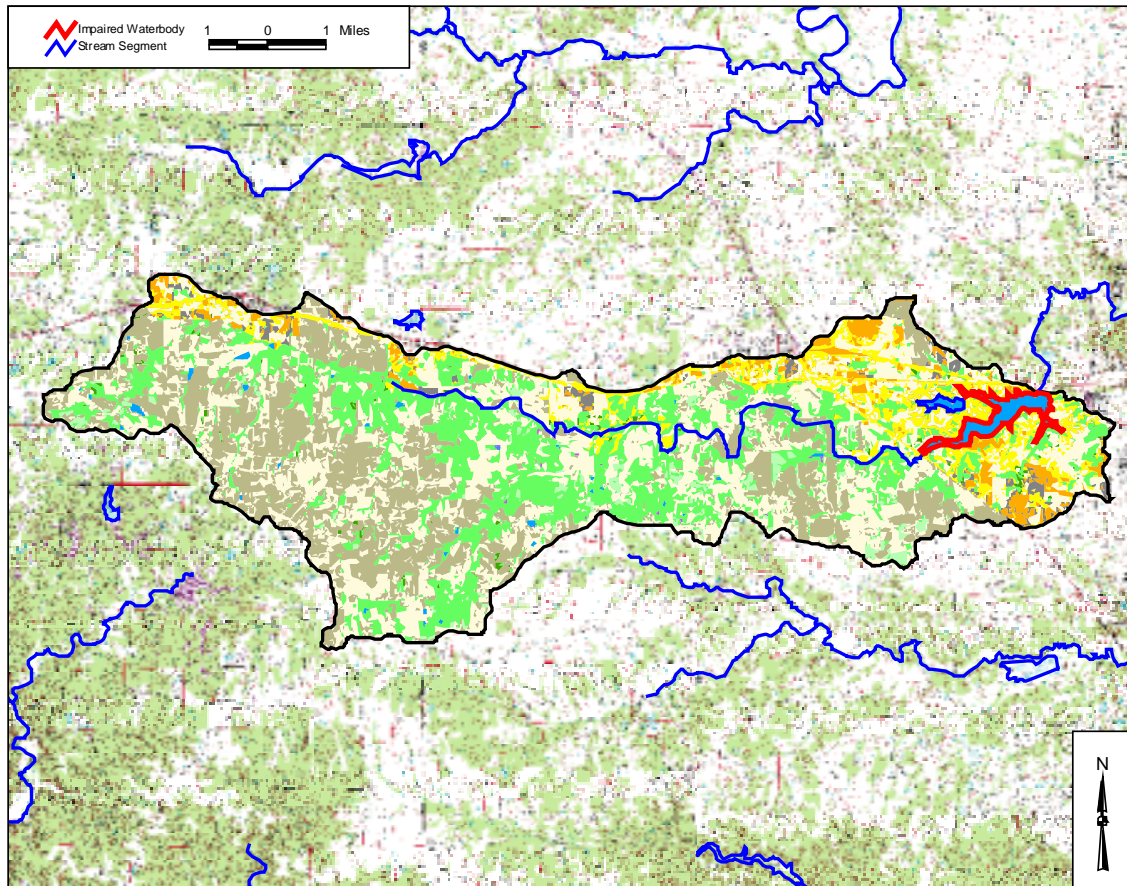
Appendix B – Location Map of Impaired Water Body

Appendix C – Data with Discussion

Other Information on File:

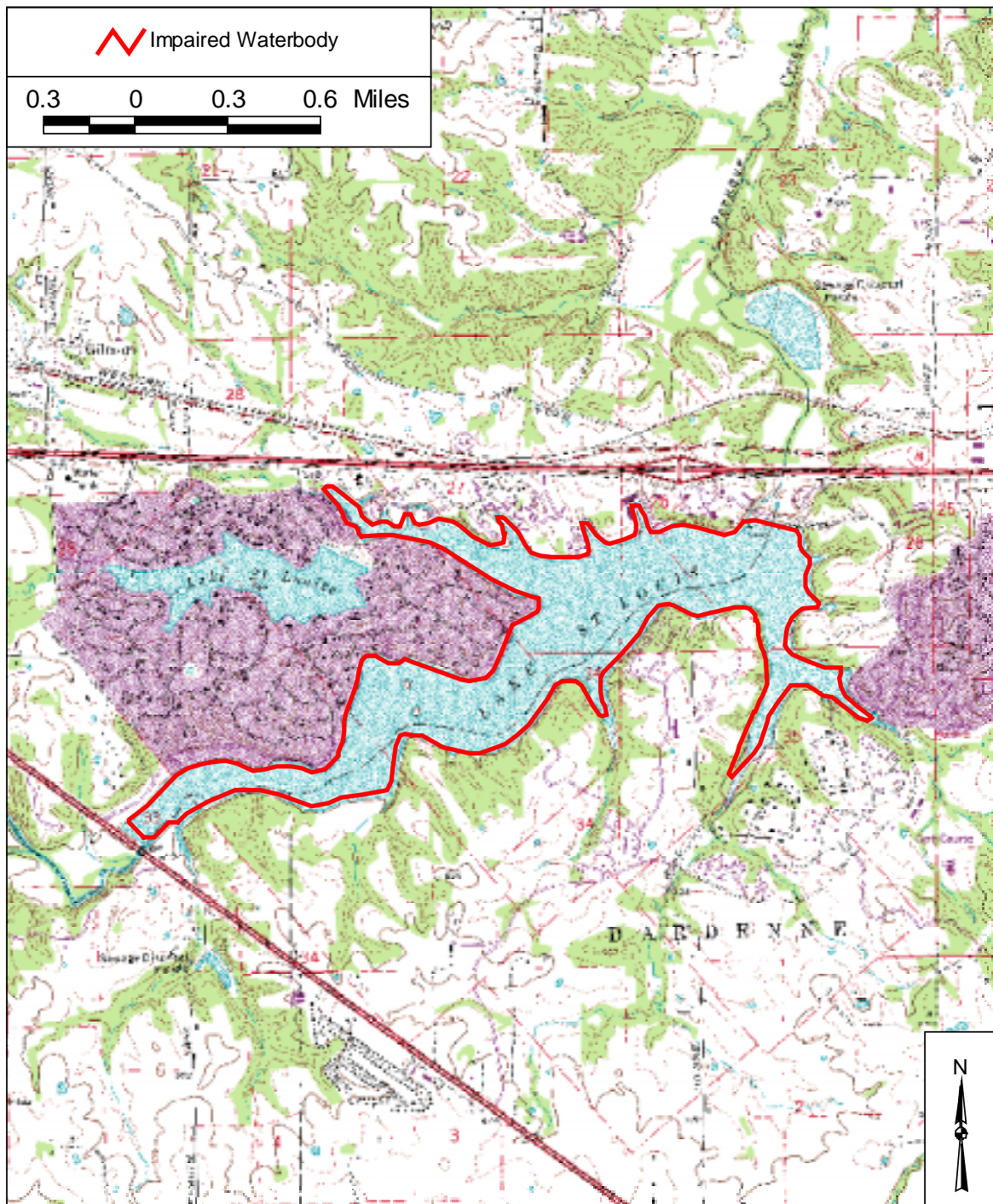
- Fish Consumption Advisories from 1985 to the present outlining safe consumption of fish.
- “Relationship Between Fish Consumption and Serum Chlordane Levels” by Evans, et al, 6/94, *Journal of Environmental Health*. This paper studied the appropriateness of fish consumption advisories in Missouri rivers. It concluded health advisories based upon fish sampling techniques do not reflect the risk of exposure to chlordane. After this study, the Missouri Department of Health changed its fish advisories from *where* fish were taken to *how much* fish was consumed.

Appendix A. Land Use Types for Lake St. Louis Watershed (07110009-010001)



Land Use Type	Area (acres)
Urban Impervious	1352
Urban Vegetated	2937
Barren or Sparsely Vegetated	491
Row and Close Grown Crops	9226
Cool-season Grassland	12005
Warm Season Grassland	0
Glade Complex	0
Eastern Redcedar and Redcedar-Deciduous Forest and Woodland	756
Deciduous Woodland	187
Upland Deciduous Forest	8585
Shortleaf Pine-Oak Forest and Woodland	0
Shortleaf Pine Forest and Woodland	0
Bottomland Deciduous Forest and Woodland	28
Swamp	0
Marsh and Wet Herbaceous Vegetation	0
Open Water	632

Appendix B. Map of Impaired Waterbody Lake St. Louis, St. Charles County, Missouri



Appendix C

Chlordane Data for Lake St. Louis with Discussion

The data for Lake St. Louis (Table 1) are spotty. Though MDC analyzes fish tissue every year, it does not analyze fish from Lake St. Louis every year. Table 2 shows that carp and channel catfish are the fish of concern since their chlordane levels exceed the U.S. Food and Drug Administration action level of 0.3 mg/kg (see Specific Criteria in section 2). They are bottom dwelling organisms and are exposed to chlordane while feeding or dwelling near chlordane-contaminated sediments. Table 3 lists the data for carp, catfish and buffalo, since they are all bottom dwellers. The graph uses the data from Table 3.

Table 1. Available Data on Chlordane in Fish Tissue from Lake St. Louis, St. Charles County, MO (mg/kg)

Species	Year	Chlordane
Largemouth Bass	1987	0.161
Channel Catfish	1987	0.33
Carp	1987	2.066
Bluegill	1987	0.089
Largemouth Bass	1987	0.066
Channel Catfish	1987	0.295
Carp	1987	0.059
Carp	1998	0.103
Largemouth Bass	1998	0.015
Smallmouth Buffalo	1998	0.099
Largemouth Bass	1999	0.015
Carp	1999	0.061
Carp	2000	0.03
Largemouth Bass	2000	0.015

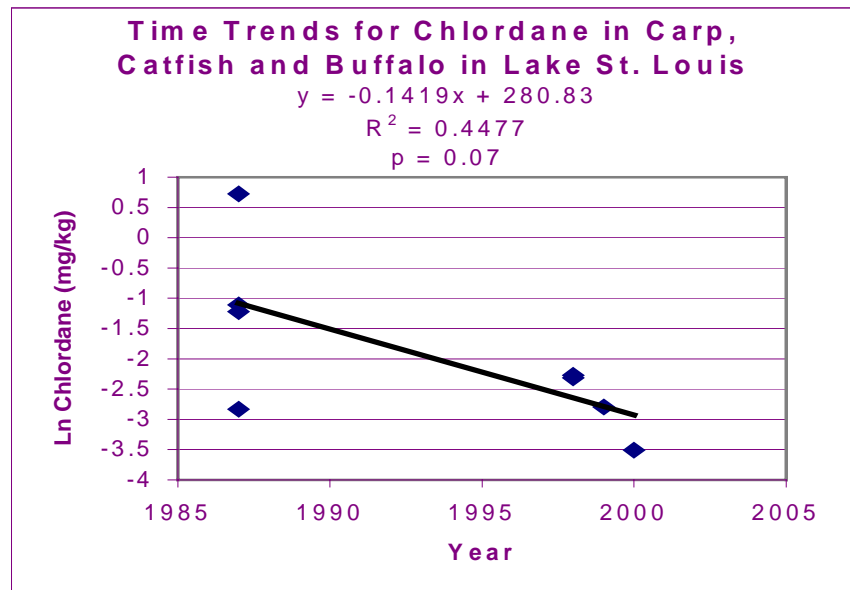
Table 2. Average Chlordane Level by Species (mg/kg)

Species	Chlordane	No. of Samples
Bluegill	0.089	1
Carp	0.4638	5
Channel Catfish	0.3125	2
Largemouth Bass	0.0544	5
Smallmouth Buffalo	0.099	1

Table 3. Chlordane in Carp, Channel Catfish and Buffalo by Year (mg/kg)

Year	Chlordane	Ln Chlordane
1987	0.33	-1.108662625
1987	2.066	0.725614371
1987	0.295	-1.220779923
1987	0.059	-2.830217835
1998	0.103	-2.273026291
1998	0.099	-2.312635429
1999	0.061	-2.796881415
2000	0.03	-3.50655

The graph below is based on the natural log (Ln) of the chlordane data, which allows a linear regression (straight-line graph). From this graph, an analysis was performed to determine if the chlordane concentrations are decreasing with time. The result was that the data cannot be explained by chance, such as environmental variations or sampling and analytical errors, alone. That is, the data is apparently decreasing with time. Fish tissue samples contained less than the FDA action level of 0.3 mg/kg of chlordane in the most recent two monitoring periods. As a result, the statewide fish consumption advisory regarding chlordane has been discontinued by DOH. The department intends to continue monitoring for chlordane in fish tissue to document the decline.



Data Sources: Missouri Departments of Natural Resources and Conservation